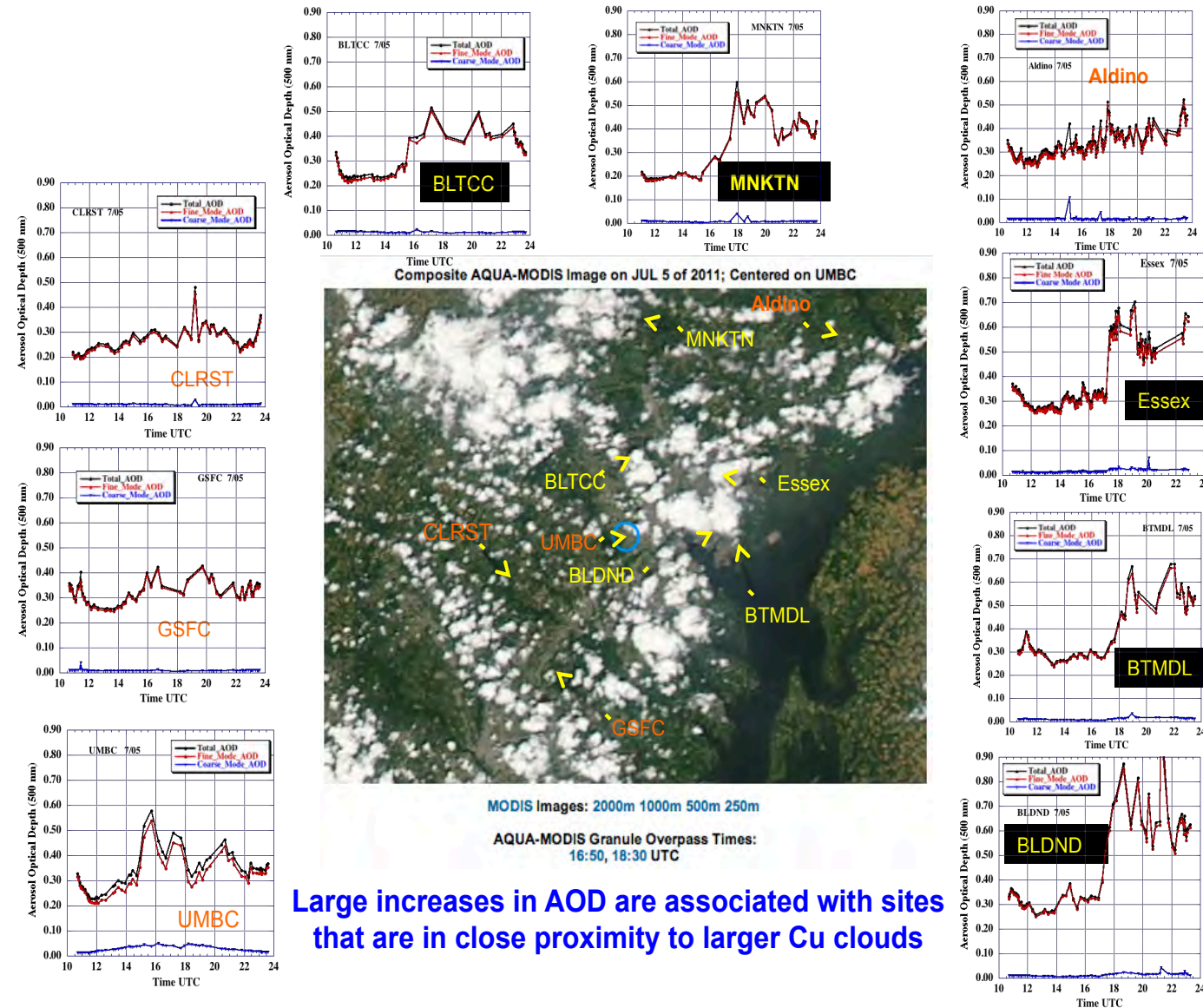


Observations of rapid aerosol optical depth enhancements in the vicinity of polluted cumulus clouds

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During July 2011 in Maryland, large and rapid enhancements in AERONET measured Aerosol Optical Depth were observed in the immediate vicinity of fair weather cumulus clouds on some days. Measures of aerosol size made before, during and after cumulus development suggested little change in fine mode particle size, therefore implying possible new particle formation in addition to cloud processing and humidification of existing particles.



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References:

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Data Sources: Most of the measurements we have analyzed were made by sun-sky radiometers that are a part of NASA's AEROSOL RObotic NETwork (AERONET; Holben et al., 1998)), which is a federated global network of standardized radiometers calibrated to consistent reference sources and processed with state of the art algorithms. Over 400 sites located in diverse environments on all continents and oceanic islands are currently a part of AERONET. Most of the the AERONET sites analyzed in this study were from the Distributed Regional Aerosol Observation Network (DRAGON) of ~45 Cimels deployed in Maryland in July 2011 in support of the Deriving Information on Surface conditions from Column and Vertically Resolved Observations Relevant to Air Quality (DISCOVER-AQ) field experiment. Additionally airborne in situ aerosol measurements from the NASA Langley LARGE group were analyzed, plus both ground-based and airborne lidar data sets. Satellite data examined in this study were MODIS Terra and Aqua data as analyzed by the MAIAC algorithm, plus GOES East imagery.

Technical Description of Figures:

Figure 1: The Aqua MODIS satellite image centered on the UMBC site for July 5, 2011, showing the locations of selected AERONET sites. The time series of the fine and coarse mode AOD for each of these AERONET sites as determined by the Spectral Deconvolution Algorithm (SDA) are also shown. From this figure it is noted that sites in near proximity to the larger cumulus clouds showed significant afternoon increases in fine mode AOD (see BLDND and MNKTN sites for examples)), while sites that were in relatively cloudless regions or had mostly small cumulus cloud cells showed relatively stable AOD from morning through afternoon (see GSFC and CLRST sites for examples). Lidar measurements showed modifications of the aerosol vertical profile, and were also used to determine that the increased AOD, backscatter and extinction extended out to 2.5 kilometer average distance from the cloud edge.

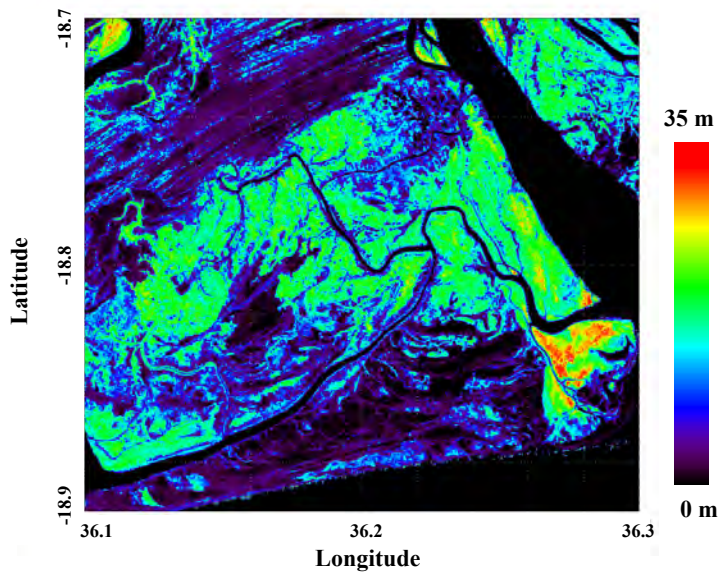
Scientific significance, societal relevance, and relationships to future missions: The interaction of aerosols and clouds and resultant effects on aerosol optical depth and size distribution currently contribute to significant uncertainties in radiative forcing of aerosols at the earth's surface and the top of the atmosphere. AERONET measurements of AOD and retrieval of aerosol optical and physical properties such as size distributions have and will continue to be utilized in climate forcing studies and in the validation of current and future satellite missions.



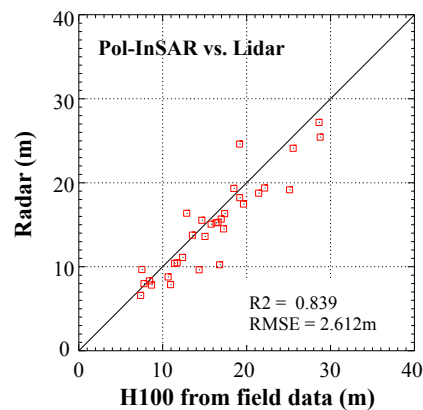
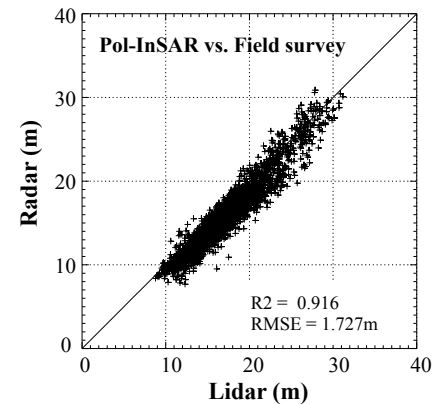
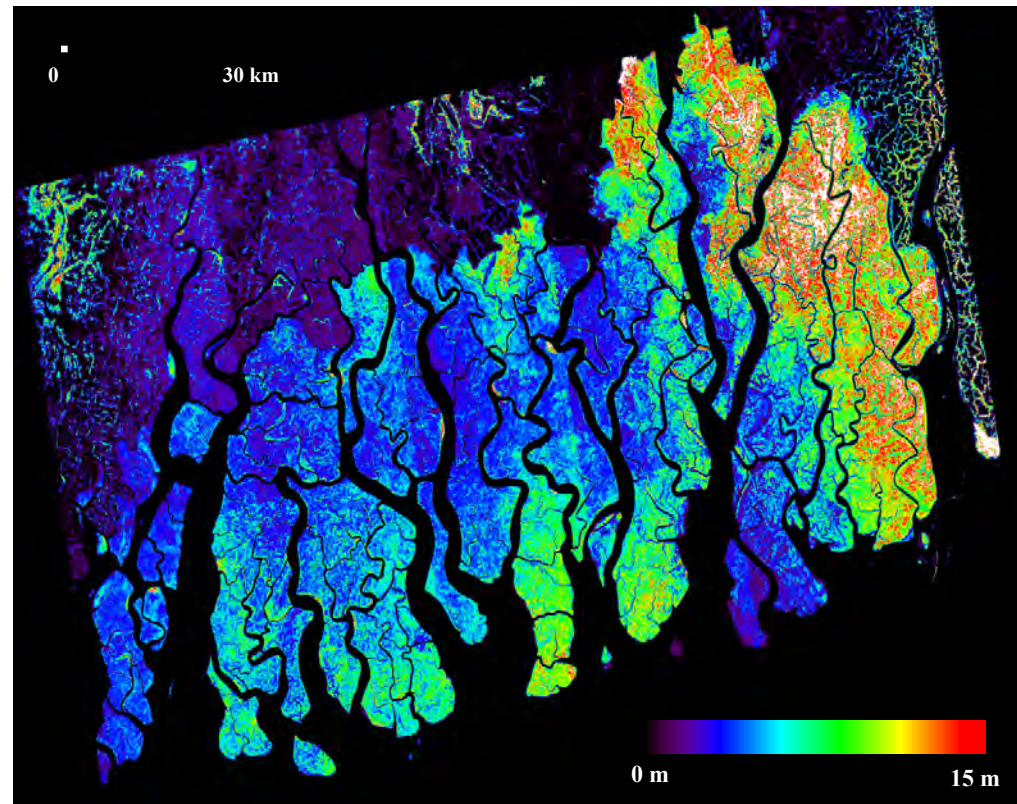
TanDEM-X Pol-InSAR Inversion for Mangrove Canopy Height

Seungkuk Lee, Temilola Fatoyinbo, David Lagomasino, Biospheric Sciences, NASA/GSFC

Zambezi Delta in Mozambique



Sundarbans in Bangladesh and India



Mangrove canopy height can be estimated using Pol-InSAR technique from TanDEM-X data with a height estimation error of 10 %. The approach shows a great possibility to generate large/global scale mangrove canopy height and biomass estimates.



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References: S.-K. Lee and T. E. Fatoyinbo, "TanDEM-X Pol-InSAR Inversion for Mangrove Canopy Height Estimation", *IEEE J. Sel. Top. Appl. Earth Obs. Remote Sens.* (in review).

Data Sources: TanDEM-X and TerraSAR-X

Technical Description of Figures:

Graphic 1: TanDEM-X Polarimetric InSAR (Pol-InSAR) inversion results over a mangrove region in the Zambezi Delta, scaled from 0m to 35 m. The validation results against lidar and field measurements showed a very good correlation between both the lidar canopy heights and the Polarimetric InSAR data, and between the field measurements and the Polarimetric InSAR inversions of Canopy Height in the Zambezi Delta region in Mozambique. This map was produced as part of SK Lee's NASA Postdoctoral Project and an ongoing Carbon Monitoring System project entitled "Total Carbon Estimation in African Mangroves."

Graphic 2: Mosaic mangrove forest height map over the Sundarbans forest of India and Bangladesh estimated by the Pol-InSAR technique. To make this large-scale mangrove height map, 24 TanDEM-X data sets acquired from Jan 11, 2011 to Jan 1, 2013 were selected and inverted using the new techniques developed in the above-mentioned paper. This map was produced as part of SK Lee's NPP and also as the NASA contribution to the SilvaCarbon Bangladesh project.

Scientific significance, societal relevance, and relationships to future missions:

One of the greatest challenges for the accurate estimation of forest carbon storage and emissions has been the accurate estimation of forest structure and biomass on large scales. Mangrove forests in particular are the most carbon rich ecosystem in the world and despite their limited distribution on coastal areas, their contribution to the Global Carbon Cycle is significant. This approach indicates a great possibility for generating global-scale mangrove height and biomass maps using polarimetric and Interferometric SAR data acquisitions. This is significant scientifically as it confirms that we can achieve canopy height estimates with accuracies comparable to airborne lidar with this new Pol-InSAR technique but with wall-to-wall coverage and regardless of cloud cover. It is of great societal significance as well as it can be implemented operationally into MRV (monitoring, reporting and verification) schemes being developed by International organizations such as the UN-REDD program (Reducing Emissions from Deforestation and Degradation) to adapt to and mitigate the effects of climate change on our Planet. Finally, this capability is also key to current and future missions, such as the EcoSAR airborne SAR and the recently selected Global Ecosystem Dynamics Investigation (GEDI), which will produce fused biomass data products using TanDEM-X and GEDI footprints.